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APPROACHES FOR TEACHING PLANETOLOGY

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I. INTRODUCTION

The primary objective of the "Short Course in Lunar Geology" is to provide information and ideas for instructors so that aspects of planetology can be introduced or expanded in their earth-science curriculum. Although the ways that this is accomplished are probably as varied as the number of participants, I would like to offer some suggestions for incorporating planetology into earth-science programs. Three general possibilities are: 1) supplemental instruction in existing courses, 2) introduction of special projects or formal courses in planetology, and 3) introduction of short-courses for high school instructors, or as community affairs programs.

II. PLANETOLOGY IN EXISTING COURSES

Community college earth-science instructors generally teach a variety of courses (physical geology, historical geology, physical science, astronomy) in which the solar system, "Earth's place in space," and the early history of the Earth are discussed. A great deal of the recent information on the characteristics of the solar system and ideas of its origin has come from lunar and planetary programs. Thus, it would be appropriate to expand and supplement lectures with the data gained through their short course in regard to geochemistry, ages of lunar material, and characteristics of the terrestrial planets. Now that lunar landings have been accomplished and large photographic libraries are being compiled from detailed views of other planets, Solar System astronomy has changed drastically. The study of surface features is basically the field of the geologist, not the astronomer. Consequently, the topics in Solar System astronomy over the last decade have been redirected to the outer planets, to meteorological problems, to comets, and to the relatively "inaccessible" (as yet) planetary objects. The study of planetary surfaces is typically approached by astronomers as an aside. However, this topic is closest to the field of the geologist.

In one form or another, earth-science courses discuss *geological processes.* One approach for planetology is to show that the same geological processes are (or have been) operative on all terrestrial planets. Impact cratering as a geological process is usually neglected in general geology, even though it has been significant in the evolutionary history of most planets, including the primitive Earth. Comparisons of the relative effects of impact cratering as well as other processes (volcanism, gradation, and tectonism) for each planet could be discussed and supplemented with spacecraft imagery.

The basic concepts and principles of geology (superposition, uniformity, etc.) are used to decipher the geology of the other planets, just as they are used for Earth. As these topics are discussed, extraterrestrial cases could be cited. For example, the Imbrium lava flows photographed by Lunar Orbiter and Apollo 15 demonstrate superposition on a grand scale! Or, craters cut by

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linear rilles (graben) show cross-cutting age relations for the formation of the crater and lunar crustal faulting. In addition, extrapolation of meteoritic flux data and "real-time" cratering events backwards through geologic time permits an understanding of the geological history and evolution of the Moon, demonstrating *geological uniformity*.

III. PLANETOLOGY AS A COURSE

Some schools have already initiated separate courses in space science, or lunar and planetary geology. These courses often start as reading projects or seminars (e.g., "Geological Exploration of the Moon and Planets"), and evolve into formal courses. Depending on the background of the instructor and the student population, the theme of the courses varies from photogeology, geochemistry, or geophysics to general space sciences, etc. Some courses are restricted to the Moon; others cover the Solar System.

This short course could serve as a core for a lunar geology course of about four (4) quarter units. With laboratory, it could satisfy State requirements as a physical science laboratory course. A sample class schedule for the Planetary Geology course that I teach at Foothill College is included here.

IV. SHORT COURSES

A general function of community colleges is to offer public service programs. Most communities have a ready-made audience for short courses in lunar and planetary geology through local and campus astronomy clubs. Short courses and special lecture series organized as community programs are particularly effective when they coincide with planetary probes (e.g., Pioneer 11, 1974; Viking-Mars, 1976; etc.).

Nearly all high schools teach physical science and many have initiated earth-science courses. They, too, could offer aspects of planetology in their normal curriculum. Short courses could be organized for high school instructors and offered for extension credit along the same general theme as this short course.

V. LABORATORY EXERCISES

Regardless of the approach taken to introduce planetology in the earth-science programs, laboratory exercises should be an integral part of the curriculum. We traditionally use the "do and learn" method in geology and this is true of planetology as well. Exercises in addition to those that are part of this short course are given in the accompanying material. Most of these can be adapted directly to the classroom, depending upon student level and instructor interest.

Material for the exercises (photographs, maps, etc.) can be obtained from the sources listed in the Appendix of the chapter, "Educational Resources."